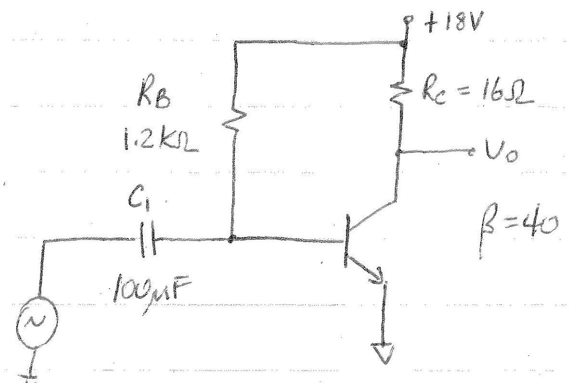
Chapter 12 #1 - 4

(1) Calculate the input and output power the circuit (of figure below) The input signal results in a base current of 5mA rms.



a) Find DC power.

$$I_{BQ} = \frac{18 - 0.7}{1.2k\Omega} = 14.42\,mA$$

$$I_{CQ} = \beta I_B = 577\,mA$$

$$P_S = V_{CC}\left(I_{CQ} + I_{BQ}\right) = 18\left(577mA + 14.42mA\right) = \underline{\underline{10.64\,W}}$$

b) find ac power delivered to R_C.

$$i_c = \beta i_b = 40(5mA) = 200mA$$

$$P_{ac} = i_c^2 R_C = (200mA)^2 (16) = \underline{\underline{0.64\,W}}$$

c) $$\eta = \frac{P_{ac}}{P_{DC}} \times 100 = \frac{0.64mW}{10.64mW} \times 100 = \underline{\underline{6.02\%}}$$

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(2) Calculate the input power dissipated by the circuit (of fig. below) if R_B is change to 1.5K.

$$I_{BQ} = \frac{18-0.7}{1.5K} = 11.53\,mA$$

$$I_{CQ} = \beta I_B = 461.3\,mA$$

$$P_{DC} = V_{CC}(I_{BQ} + I_{CQ}) = 18(461.3\,mA + 11.53\,mA) = \underline{\underline{8.52\,W}}$$

(3) What maximum output power can be delivered by the circuit (of fig. below) if R_B is changed to 1.5K.

from #2 $I_{CQ} = 461.3\,mA$ $\quad V_{CEQ} = 18 - (461.3\,mA)(16)$

$= 10.62.$

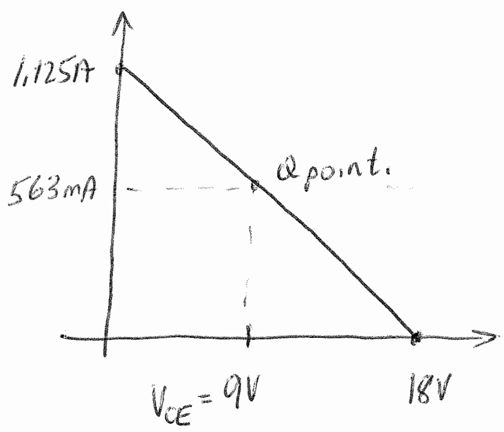
max swing $\quad 2V_{CEQ} = 21.24V$

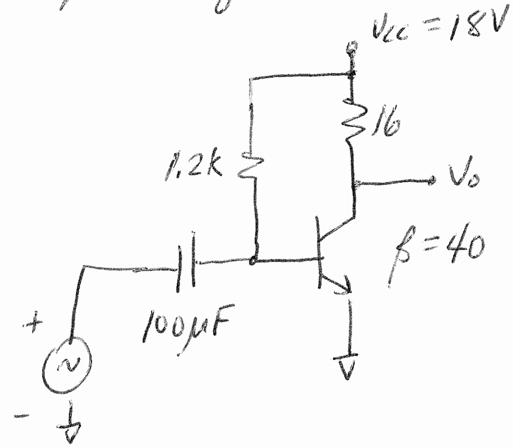
$2(V_{CC} - V_{CEQ}) = \underline{\underline{14.76V}}$

pick smaller.

$$P_{ac} = \frac{(14.76)^2}{8R} = \frac{(14.76)^2}{8(16)} = \frac{13.62\,W}{8} = \boxed{1.702\,W}$$

(4) If the circuit (of figure below) is biased at its center voltage and center collector operating point, what is the input power for a maximum output power of 1.5W.





$$1.5W = \frac{V_{o\,PP}^2}{8 R_L}$$

$v_{o(PP)} = \sqrt{8(16)(1.5)} = 13.9V$ ← not maximum swing without distortion.

So not at ~~4~~ max. eff. (25%)

$P_{IN(DC)} = V_{CC} I_{CQ} = (18)(563mA) = 10.1 W$

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